in the first book. Besides alterations of minor importance, proofs other than Euclid's are given for propositions 5, 6, 14, 24, and the first part of 26; and two additional propositions (10 A, 10 B) are introduced for the purpose of proving that all right angles are equal. It may be thought by some critics that it is injudicious to have discarded altogether so many of Euclid's demonstrations; but, in any case, additional evidence is given of the impossibility of returning to the text of the Elements pure and simple. That the idea of doing so should have, apparently, presented itself to the mind of an accomplished geometer like Mr. Taylor, is very remarkable.

The great merits of Mr. Taylor's work are sure to meet with general appreciation. Experience alone can show whether it approaches more nearly than any of its numerous predecessors the ideal of a school text-book. The reasons why one book turns out to be a good one for teaching purposes, and another not, are often difficult to discover; but we should expect the present volume to undergo the ordeal successfully.

So far as we have been able to test it, the book appears to be very accurately printed; some of the figures are not so exactly drawn as they might be, and the lines (except in Book xi.) strike us as being too thin. The occasional use of small letters instead of capitals, to denote points, is also, we think, undesirable. It is so important to preserve young eyes from unnecessary strain, that even minute details of this kind deserve attention. There is, alas! only too much reason to be assured of the editor's sympathy with the spirit of this remark; for, as we learn from an affecting passage in the preface, Mr. Taylor lost his sight while his book was going through the press. To the mathematician, as to his twin-brother, the poet, sight is perhaps the most precious of nature's gifts of sense. Happily in each case the imaginative faculty, which feels the loss of vision so keenly, not seldom supplies its best alleviation; and we sincerely trust that Mr. Taylor is still able to find solace in the pursuit of his favourite science.

In conclusion, we cannot refrain from quoting the extraordinary regulation for the Cambridge Local Examinations, as printed on the fly-leaf of Mr. Taylor's book:—

> "Proofs other than Euclid's will be admitted, but Euclid's axioms will be required, and *no proof of any proposition will be accepted which assumes anything not proved in preceding propositions in Euclid.*"

The clause which we have ventured to italicise makes proofs other than Euclid's not only admissible, but necessary; while the retention of the axioms becomes superfluous, except perhaps for sentimental reasons. How the regulation can be complied with is not very clear to the ordinary mind; perhaps a recent "demonstration" of Euclid's fifth postulate (Simson's eleventh axiom) may be the first instalment of a new geometry without assumptions. Or, possibly, the regulation may be intended as an object-lesson, to illustrate the truth of the assertion that Cambridge graduates cannot write plain English, and thus to support the present agitation for imposing some test of composition in the Little-Go?

G. B. M.

RECENT HISTORY OF THE CARBOHYDRATES.

Kurzes Handbuch der Kohlenhydrate. By B. Tollens. Band ii. Pp. xvi + 407. (Breslau: E. Trewendt, 1895.)

THERE is not much apparent analogy between the province of the carbohydrates and the African continent; but viewed as arenas of research, discovery, and appropriation, they present very similar histories. The author of the work before us has accepted the mission of record-keeper in the march of annexation in the first-named and more abstract region, and he must have found his office during the last ten years quite as engrossing as those who provide us with maps of the once dark continent.

The volume is supplementary to that which appeared in 1888 under the same title (Band i.), and deals with events in this extremely interesting field of enterprise, up to last year (May 1895). If it were not for the self-evident fitness of the number 7, we might have pronounced the selection of time for antiquating the earlier volume as somewhat hasteful; but that would have been before acquainting ourselves with the contents of the present vol. ii. Afterwards, we have merely to record our conviction that seven years has become "quite a" period in "chemical time." Of course, this effectual antiquating of vol. i. in no sense lessens its historical value, and it will continue to occupy a not "too top-shelf" in our library of working manuals.

Like its predecessor, the book is substantially a reprint of an article or monograph written for the "Handwörterbuch der Chemie" (Ladenburg). It is necessarily therefore cyclopædic in style, and restricted in its treatment of the subject to the experimental results of investigations, and their immediate bearings upon current developments of chemical theory pure and simple. Seeing that in the compass of 370 pages the author deals with the substance of 1200 original papers, it will be gathered that he has not indulged in much speculative discussion of the problems peculiar to this borderland between chemistry and physiology. He has produced rather a rigid *précis* of positive results, and, backed by his well-deserved reputation for thoroughness and critical exactitude, the book needs no further recommendation to chemical specialists. But the subject appeals to a wider circle of readers, and it may not be out of place to examine the author's work from a somewhat broader point of view.

The lines of classification adopted are, of course, those laid down and developed by Émil Fischer, and expounded by himself in his two monumental dissertations, "Synthesen in der Zuckergruppe" (*Deut. Chem. Ges. Ber.*, 1890, 2114; 1894, 3189). These are dealt with in the earlier sections. The basis of the isomeric relationships of the glucoses and their immediate derivatives is briefly set forth. In respect of constitution, the discussion as between an aldehyde or ethylene oxide formula for the typical glucose is impartially summed up. We may remark on this important point, that there is no suggestion of the probable influence of aqueous solution. The very recent researches of Lobry de Bruyn (*Rec. Trav. Chim.*, 1895, 14, p. 203), showing that mannose, dextrose, and fructose are reciprocally transformed, each into the two

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others by the action of sodium hydrate in aqueous solution, are a striking illustration of the mobile equilibrium of the typical CO group, and of the ease with which its migration is determined. That changes of structure take place in aqueous solution is evidenced by the phenomena of rotation, and the influence of hydrolytic agents points to a very direct connection with changes of "ionic" equilibrium. A grouping of these relationships, with a not too positive conclusion as to their significance, would have added a suggestive section.

From constitution the author proceeds to configuration, the section consisting in the main of Fischer's well-known tables. In the next edition these may be accompanied with advantage by the mnemonic symbols recently proposed by Lobry de Bruyn (*Chem. Zeitung*, 1895, No. 75), or by some similar pictorial concession to the limitations of the average memory. In the nomenclature of the group, there is the usual struggle between systematic and trivial terms. There is some ambiguity created in the numerical basis of the terminology, as between the number of C atoms in the molecule of a simple carbohydrate, and the number of such simple units in the condensed molecule of a "polysaccharide." Thus the term "triose" designates a glycerose of the dimensions C_3, and the sugars of dimensions $3C_6$. The author evidently avoids innovations in this direction, and it is not for us to step in where the leaders fear to tread. In the following sections, dealing with the experimental methods of general significance, whereby the relationships of constitution and configuration have been elucidated, the treatment of the subject is of the briefest. The sections which suffer most under the severe discipline of brevity are those devoted to "the formation of the carbohydrates in nature," and to "fermentation." The former is chiefly devoted to the recent work of Brown and Morris, and the latter to Fischer's observations on the relationship of fermentation to configuration. It is evident that much matter of the greatest interest to physiologists is left unnoticed. We can only regard the omission as expressing the author's judgment that this province still refuses to yield to the positive methods of a systematic handbook. From this condensed review of the generalities of the subject, we are taken at once to the description of the individual compounds in systematic order: glucoses, saccharoses, and polysaccharides. It would be gratuitous to say anything in commendation of these sections. They constitute a condensed reproduction in strictly systematic order of the very prolific researches of the last few years, and the labour which they represent on the part of the author will be fully appreciated by specialists. Anything which might be said in depreciation of these sections could only be translated into the common-place that no one can be a general specialist; and in the chemistry of the carbohydrates the specialising process has passed into the second degree, as witness the literature of the sugars, of starch, of cellulose. The consequent difficulty of subordinating the parts of so wide a subject to the main plan has been effectually overcome in the work before us. The remainder of the work is devoted in order to the alcohols, to derivatives of the cyclic hexamethylene, and lastly to the complex groups of acids which stand in relationships of the first or more remote degrees to the carbohydrates.

The work, therefore, satisfactorily exhausts the recent history of the subject in its systematic relations; on the other hand, to those who have the fear that the objectives of the science in this fertile field of research are being rapidly exhausted, we may speak a word of comfort in the reflection *l'appétit croît en mangeant*. It is evident that, although the writer limited himself to the plan of a somewhat "high and dry" dictionary article, and in enlarging his text to confer upon the article the standing of an independent monograph, keeps well within the limits of history, the subject-matter is continually breaking bounds and revealing by implication the remarkable further developments which it promises on every hand. The natural history of the carbon compounds remains to be written. There is abundant evidence in the recent history of the chemistry of the carbohydrates that this new objective of the science is taking positive shape. These compounds constituting in a prominent degree the arena for the primary processes of natural organic synthesis, it is in the order of things that the fundamental relationships of these compounds should be first elucidated as the necessary basis of plant physiology. It would take us much beyond the obvious limits of the matter in hand to attempt a discussion of the many broad physiological issues directly raised by the results of the last seven years' investigations. We would suggest that the author's next volume should treat this side of the subject specially and adequately. We should also suggest an historical preamble and a brief survey of the chief developments marking the period. With these slight qualifications, we heartily commend the book to all students of natural science.

OUR BOOK SHELF.

Practical Inorganic Chemistry. By Dr. G. S. Turpin, M.A. Pp. 158. (London: Macmillan and Co., 1895.)

IT is gratifying to all who are interested in scientific education to know that instruction in elementary science in this country is steadily improving, both in methods of teaching and in the subjects taught. In the spring of this year, a new scheme of work for organised science schools was issued by the Department of Science and Art. These schools include all the best carried on in connection with the Department, and for some time a definite scheme of study, extending over three years, has been followed in them. What the Department did recently was to issue a remodelled scheme for such schools, embodying several commendable features. Elementary practical physics was introduced as an obligatory subject, and a course of real chemistry was substituted for the drill of test-tubing, which had gone under the name of practical chemistry for so long. Dr. Turpin's book has been designed to meet the improved requirements; and, as it has had a reasonable basis for its construction, it possesses many good qualities. The course of work described begins with weighing, measuring, the determination of relative density, and other elementary physical principles; then follows a chapter on mixtures and compounds, and another on the setting-up of apparatus. After this fundamental knowledge has been experimentally studied, the constitution of the air is investigated, and then the most important gases, and common chemical compounds, form the subjects of the student's work for the remainder of the course. We cannot speak too highly

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